The continuous scaling of Si devices has guided the microelectronics into the era of nano electronics when the components are with nanoscale dimensions. While manufacture aspects dominated the problems of scaling in the past, one now faces the first fundamental physical limitations as structures approach atomic dimensions. SiO_2 is most commonly used gate dielectric in electronic devices like DRAMs. Miniaturization of devices can be accomplished by reducing the thickness of the dielectric. When the thickness of SiO_2 is reduced below 2nm, there is adverse increase of leakage current due to quantum tunneling of electrons through SiO_2 layer and the device will malfunction. The leakage current increases exponentially with decrease in thickness of the dielectric. Therefore only alternative is to replace SiO_2 layer with any other high dielectric oxides like TiO_2, $SrTiO_3$, $BaTiO_3$. The thickness of SiO_2 used now is about and below 1.4 nm. The most effective approach to overcome the fundamental limits for SiO_2-device scaling is the use of new, alternative dielectrics with high dielectric constant k. With high-k dielectrics the desired equivalent oxide thickness (EOT) can be achieved concurrently with a reduced current by increasing the physical thickness.

The objective of this thesis work is to study the electronic structure of high dielectric oxides like TiO_2, $SrTiO_3$ and $BaTiO_3$ etc. deposited on Si(111) surface. When oxides are deposited on Si there may be possibility of interactions like metal-oxygen, metal-silicon, silicon-oxygen and metal-silicon-oxygen. All these interactions influence the physical and chemical properties that are important for technological applications. Therefore, investigation of these interaction strengths is a major concern for device fabrication. In this work three samples TiO_2, $SrTiO_3$ and $BaTiO_3$ have been synthesized. Bulk $SrTiO_3$ and $BaTiO_3$ were prepared by solid state reaction technique. TiO_2, $SrTiO_3$ and $BaTiO_3$ thin films on Si(111) surface were deposited by pulsed laser deposition technique. Both bulk and thin film samples have been investigated using X-ray Diffraction (XRD), Raman spectroscopy, X-ray Photoelectron spectroscopy (XPS) and Atomic Force Microscopy techniques. Both XRD and Raman data suggests the deposited TiO_2 is in anatase phase. The binding energy peak position of Ti 2p also supports the formation of anatase phase. The AFM topography of as deposited film indicates the formation of non uniform TiO_2 growth with the formation of voids on Si(111) substrate which disappeared after sputtering with

argon ion beam due to surface erosion. The Ti 2p core level of sputtered TiO_2 exhibits the formation of Ti_2O_3, TiO and pure Ti on the surface. After sputtering the high binding energy shoulder of O1s peak becomes sharp. Ti LMM Auger peaks become broader but no shift in kinetic energy is observed. The XRD pattern of $SrTiO_3$ and $BaTiO_3$ were indexed assuming a cubic structure with lattice parameter of 3.905A° and 3.992A° respectively. The binding energy positions of Sr 3d, Ba 3d and Ti 2p core levels observed in XPS studies indicated that Sr and Ba exist in 2^+ valence state while Ti exists in 4^+ valence state respectively. Sr 3d core level could not be resolved in to spin orbit doublets due to extra broadening occurring from oxygen defects present in the sample. An unusually broad O1s spectra for $SrTiO_3$ was also observed indicating large amount of adsorb oxygen at the grain boundaries. XPS results indicated a shift of the core levels of $BaTiO_3$/Si(111) to high binding energy by about 0.5 eV compared to the core levels of bulk $BaTiO_3$. Also the core level of the thin film are sharper compared tothe core levels of bulk sample indicating more oxygen vacancies in bulk $BaTiO_3$ compared to thin film $BaTiO_3$. The AFM topography of both $SrTiO_3$ and $BaTiO_3$ on Si(111) surface indicate the formation of nano particles.